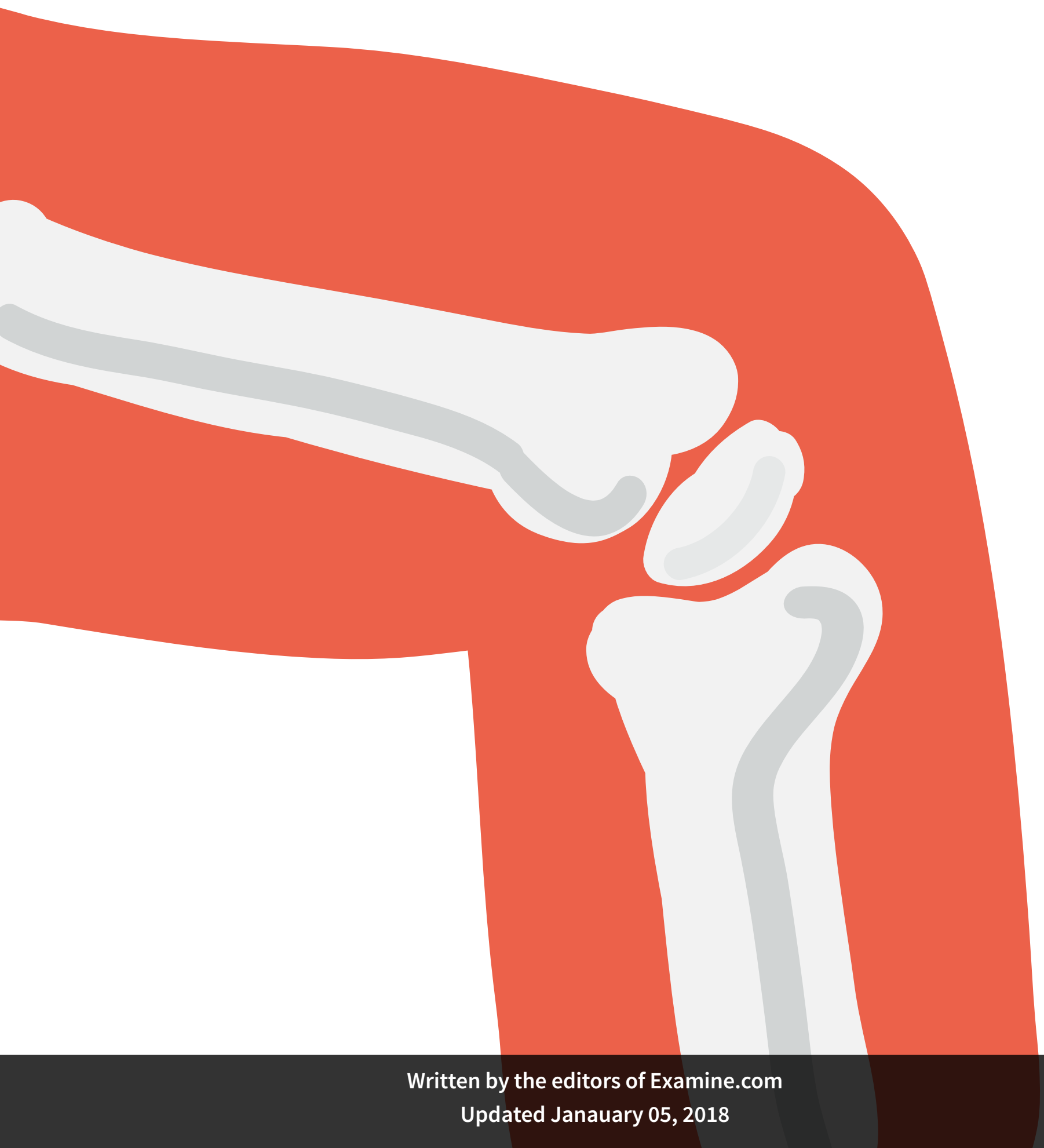
Examine.com

Joint Health Supplement Guide



Written by the editors of Examine.com

Updated Janauary 05, 2018

Medical Disclaimer

This guide is a general-health document for adults over 18. Its aim is strictly educational. It does not constitute medical advice. Please consult a medical or health professional before you begin any exercise-, nutrition-, or supplementation-related program, or if you have questions about your health.

This guide is built on scientific studies, but study outcomes are never homogeneous: individual results do vary. If you engage in any activity or take any product mentioned herein, you do so of your own free will, and you knowingly and voluntarily accept the risks. While we mention major known interactions, it is possible for any supplement to interact with other supplements, as well as with foods and pharmaceuticals.

A product may not contain the exact compounds and amounts listed on its label. Before you decide whether to take it, investigate it and its manufacturer. More than isolated compounds, herbs are prone to batch-to-batch variability, which can alter their efficacy and safety.

For evidence supporting the claims mentioned in this guide, please visit Examine.com.

Table of Contents

How to Use This Guide

The Examine.com team has been publishing research on nutrition and supplementation since March 2011. Drawing from all we've learned, we've designed this Stack Guide to help you figure out which supplements can help you reach your health goal, and which can hinder you or just waste your money.

Core supplements have the best safety-efficacy profile. When used responsibly, they are the supplements most likely to help and not cause side effects.

Primary options may provide substantial benefit, but only in the right context. A primary option is not for everyone, but if you read the entry and find that you meet the criteria, consider adding the supplement to your stack.

Secondary options have less evidence for their effects. They could work or be a waste of money. Keep them in mind, but think twice before adding them to your stack.

Promising supplements are backed by tradition or by mechanistic, animal, epidemiological, or anecdotal evidence, but not yet by convincing human trials.

Inadvisable supplements are either potentially dangerous or simply ineffective, marketing claims notwithstanding. Do not add them to your stack. At best, they'll be a waste of money; at worst, they can cause you harm.

Now that you've been presented with various supplements worthy of your interest, the time has come to combine them based on your objective. We'll guide you in **assembling your stack**.

Then comes the **FAQ**, in which we cover common questions that may arise when assembling your stack.

Lastly, we include information on **precautions and troubleshooting**.

With all this combined, you should be able to identify and assemble the supplement stack best suited to your objective.

Core Supplements

Joint pain is caused by a variety of factors. Since no supplement can address all of them, there is no core supplement shared by the different joint health stacks.

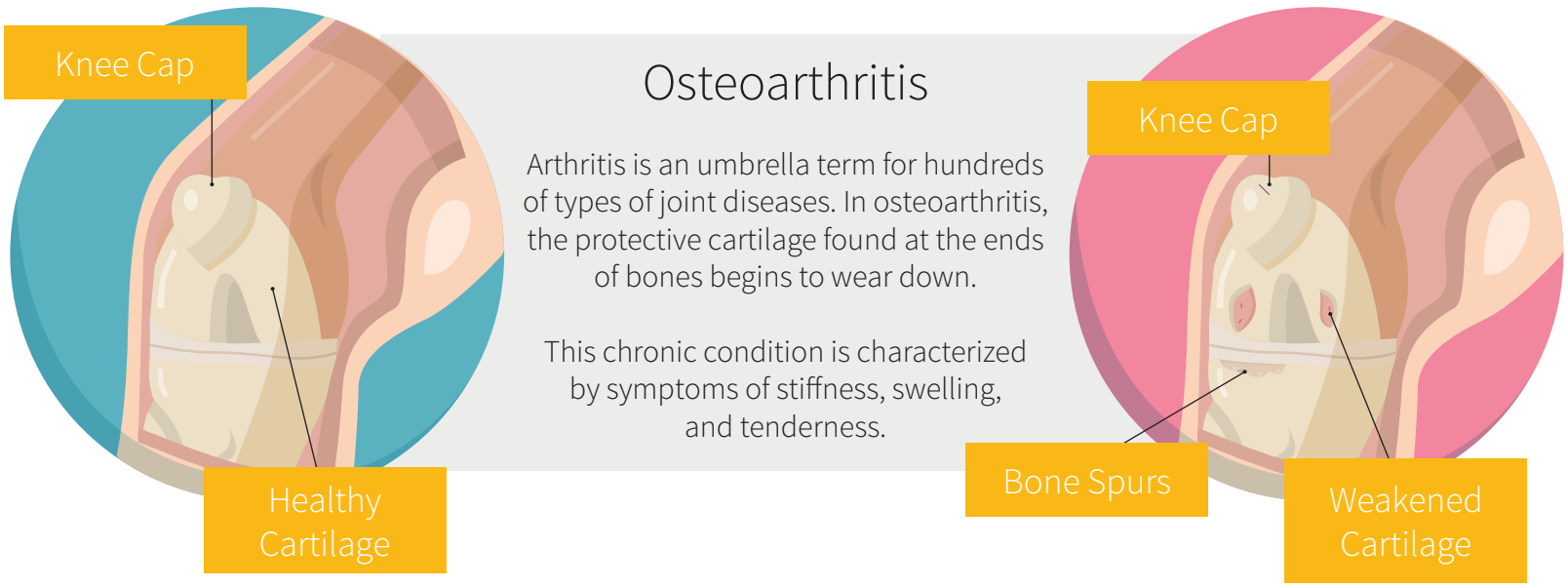
Primary Options

Boswellia Serrata

Why it's a primary option

Boswellia serrata is a plant used in Ayurvedic medicine notably to alleviate joint pain. Research suggests that it could be as effective as some pharmaceuticals for the purpose of alleviating joint pain and improving knee flexibility in people with osteoarthritis. More evidence is needed before it can be recommended for people with rheumatoid arthritis.

Figure 1: What is osteoarthritis?



In Ayurvedic medicine, *Boswellia serrata* is often used alongside *Curcuma longa* (turmeric), a plant rich in curcumin. Further research is needed to determine whether these two supplements actually have synergistic properties.

How to take it

Studies on *Boswellia serrata* tend to use one of two patented extracts: **5-Loxin** and **Aflapin**. To supplement either, take 100–250 mg once a day with food. Alternatively, you can try taking 1,800 mg of the plant's **gum oleoresin** three times a day (i.e., 5,400 mg/day).

Like curcumin, *Boswellia serrata* has been combined with lipids to increase its bioavailability (the same company that makes Meriva for curcumin makes Casperome for *Boswellia serrata*), but further research is needed to determine a dosage for joint health.

Chondroitin

Why it's a primary option

Studies on knee osteoarthritis suggest that supplementation of chondroitin (a component of cartilage) can reduce water retention in inflamed joints, improve mobility, and reduce pain.

Like collagen and glucosamine, chondroitin is a component of cartilage, and there is some evidence that it may reduce cartilage loss. With regard to joint pain and mobility, chondroitin and glucosamine show modest benefits in many studies; by contrast, collagen, *Boswellia serrata*, and curcumin show greater benefits, but studies are much fewer.

Chondroitin and glucosamine may have anticoagulant properties. This could be a problem for people taking blood thinners, be they anticoagulants (such as warfarin/Coumadin) or antiplatelet agents (such as aspirin).

How to take it

Take 600–1,200 mg of **chondroitin sulfate** per day, with food. Within this range, higher doses tend to be more effective.

Current evidence suggests that chondroitin and glucosamine may be synergistic.

Collagen

Why it's a primary option

Collagen amounts to 25–35% of total protein in mammals, which makes it the most abundant protein in our bodies.

The collagen in joint cartilage is 80–90% type-II collagen. Current research suggests that undenatured type-II collagen (UC-II) may reduce swelling, joint

pain, and stiffness in cases of moderate-to-severe osteoarthritis and both juvenile and adult-onset rheumatoid arthritis.

Collagen can be freed from the skins, bones, and other connective tissues of animals through prolonged boiling; the resulting glutinous substance is called gelatin. In effect, gelatin is collagen broken down into individual strands of protein (partial hydrolysis). Hydrolyzed collagen (HC) is collagen further broken down into peptides (total hydrolysis). Gelatin dissolves only in hot water; HC dissolves also in cool water.

Both HC and gelatin appear to reduce pain from osteoarthritis, but HC may be more bioavailable. Most gelatin on the market (and probably most HC) is type-I collagen extracted from the skins and bones of pigs and cows. Studies seldom see fit to specify the type(s) of collagen in their HC or gelatin, however, so it is unclear if selecting a product made of type-II collagen would be more beneficial to joint health.

As with chondroitin and glucosamine, two other components of cartilage, there is some evidence that collagen may reduce cartilage loss.

How to take it

To supplement **undenatured type-II collagen**, take 40 mg/day.

To supplement **hydrolyzed collagen** (also known as **collagen hydrolysate**), take 10 g/day.

To supplement **gelatin**, take 10–15 g/day. Keep in mind that, whereas true gelatin is pure collagen (thus pure protein), the dessert called gelatin often has very little collagen in it.

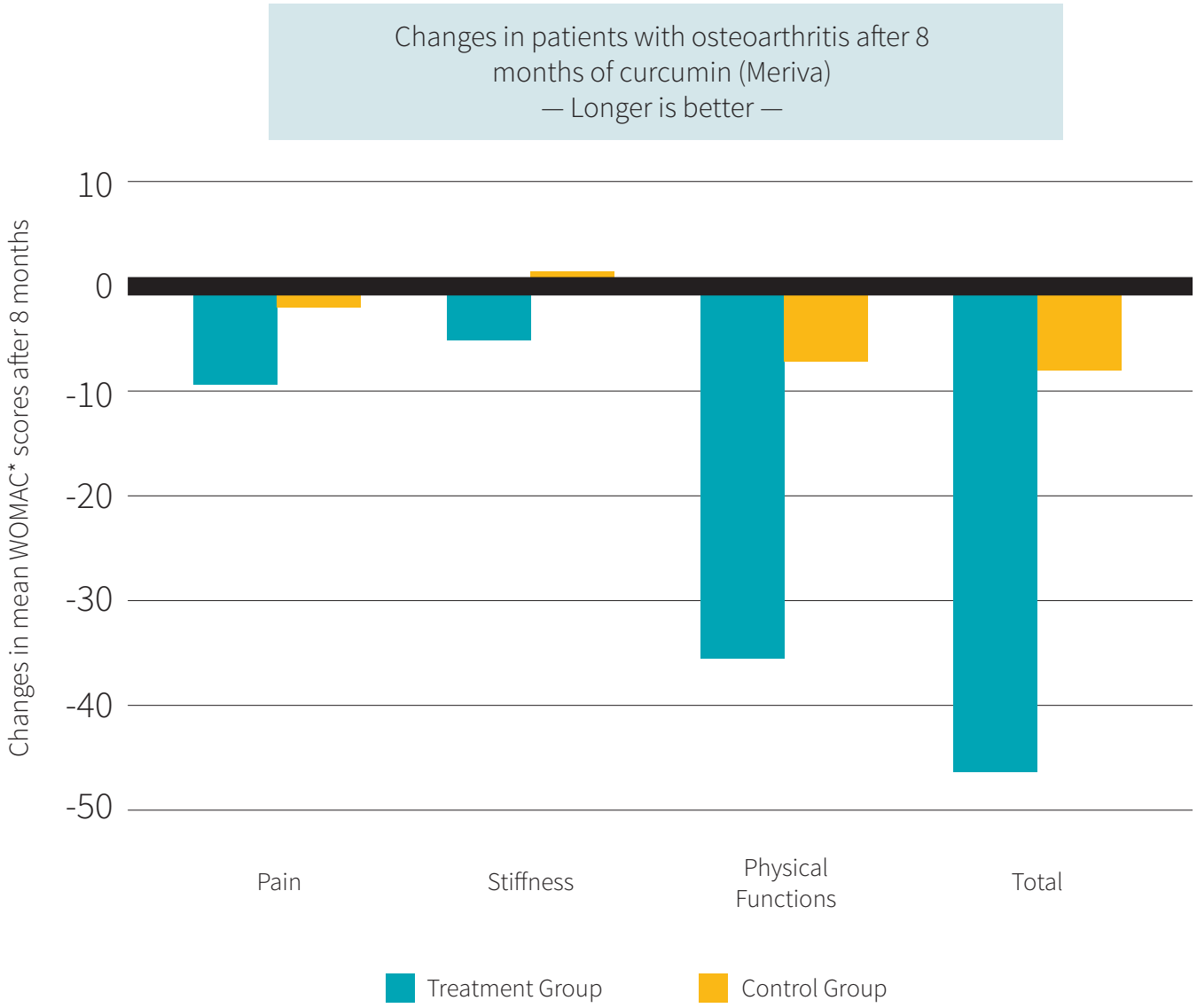
In one study, gelatin increased collagen synthesis when taken after a bout of exercise, but more research is needed to confirm this benefit and see if it extends to other forms of collagen.

Curcumin

Why it's a primary option

Curcumin is a component of turmeric (*Curcuma longa*). It can inhibit the cyclooxygenase (COX) enzymes and thus reduce inflammation in the body, so its action is similar to that of nonsteroidal anti-inflammatory drugs (NSAIDs). When supplemented by people with knee osteoarthritis, curcumin has been shown to alleviate pain and help improve mobility.

Figure 2: Curcumin's effects on patients with osteoarthritis



* The Western Ontario and McMaster Universities Arthritis Index is a set of questionnaires used to evaluate the condition of patients with osteoarthritis of the knee and hip.

Source: Belcaro et al. *Altern Med Rev*. 2010 Dec.

Some athletes use curcumin to fight muscle inflammation. In theory, curcumin should have effects similar in nature and potency to those of aspirin, and rodent studies are promising, but human studies are needed for confirmation.

In Ayurvedic medicine, *Curcuma longa* is often used alongside *Boswellia serrata*. Further research is needed to determine whether these two supplements actually have synergistic properties.

How to take it

By itself, curcumin is poorly absorbed. Among the methods devised to address the issue, the two most common (and most often tested) are to pair curcumin with piperine (a black pepper extract) or to combine it with lipids (BCM-95, Meriva).

To supplement **curcumin with piperine**, take 500 mg of the former with 20 mg of the latter, thrice a day (i.e., 1,500 mg of curcumin and 60 mg of piperine per day).

To supplement **BCM-95**, a patented combination of curcumin and essential oils, take 500 mg twice a day (i.e., 1,000 mg/day).

To supplement **Meriva**, a patented combination of curcumin and soy lecithin, take 200–500 mg twice a day (i.e., 400–1,000 mg/day).

Curcumin is usually taken together with food.

Fish Oil

Why it's a primary option

Essential fatty acids (EFAs) are polyunsaturated fatty acids (PUFAs) your body needs and cannot produce. There are only two kinds of EFAs: linoleic acid (LA) and alpha-linolenic acid (ALA). Neither is very active, so your body transforms the former notably into arachidonic acid (AA) and the latter into eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). LA and AA are omega-6 fatty acids, while ALA, EPA, and DHA are omega-3 fatty acids. EPA and DHA make for most of the PUFAs in fish oil.

Fish oil has immunosuppressive properties, so it can benefit people with rheumatoid arthritis. It has also been shown to alleviate work-related joint pain (i.e., pain not associated with a disease such as osteoarthritis or rheumatism). As such, it is frequently supplemented by athletes. Early studies

on fish oil and athletes were disappointing, but later studies (which used much higher dosages) have been encouraging.

How to take it

Get 3 g of combined EPA and DHA per day by eating fatty fish (e.g., 200 g of salmon) or by taking fish oil softgels (with food, to reduce the chance of fishy burps). Vegans and vegetarians have the option of taking algal oil softgels.

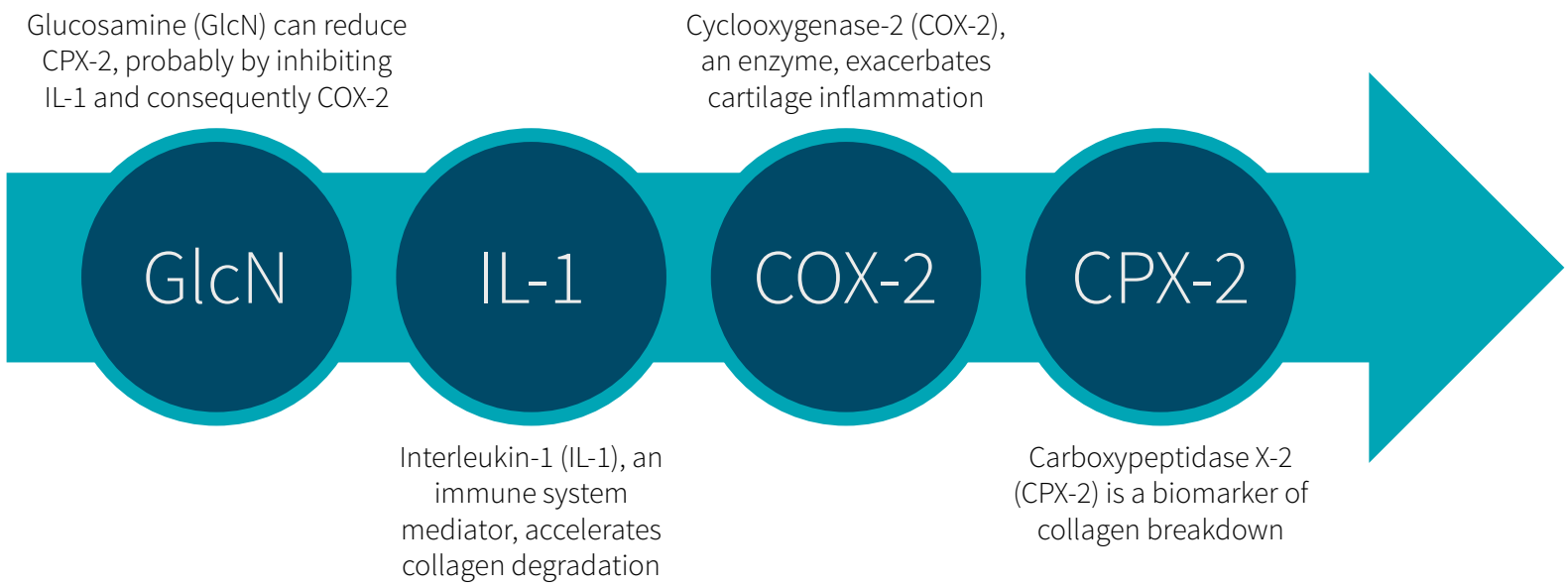
Glucosamine

Why it's a primary option

For the treatment of knee osteoarthritis, there are more trials on glucosamine (a component of cartilage) than on any other supplement. Pooled results show a reduction in pain and an improvement in function — both modest on average, but with important interindividual variability. In some people, glucosamine relieves pain as well as acetaminophen, a pharmaceutical painkiller. In others, alas, it has no effect. People taking glucosamine should monitor their symptoms to better assess if this supplement works for them.

Like collagen and chondroitin, glucosamine is a component of cartilage, and there is some evidence that it may reduce cartilage loss. With regard to joint pain and mobility, glucosamine and chondroitin show modest benefits in many studies; by contrast, collagen, *Boswellia serrata*, and curcumin show greater benefits, but studies are much fewer.

Figure 3: Glucosamine's cartilage-preserving effects



Glucosamine and chondroitin may have anticoagulant properties. This could be a problem for people taking blood thinners, be they anticoagulants (such as warfarin/Coumadin) or antiplatelet agents (such as aspirin).

How to take it

Take 1,500 mg of **glucosamine sulfate** per day, with food. Studies do not support the use of **glucosamine hydrochloride**.

Current evidence suggests that glucosamine and chondroitin may be synergistic.

Vitamin C

Why it's a primary option

Vitamin C is necessary for collagen formation, so having low levels of vitamin C can be detrimental to joint health. In people whose levels are normal, however, supplemental vitamin C has little effect on joint disorders, with one exception: It can help prevent complex regional pain syndrome (CRPS), a painful chronic condition characterized by swollen joints and by changes in skin and hair quality. CRPS can be caused by orthopedic surgery or a joint injury.

Vitamin C may reduce the effectiveness of some HIV medications. Moreover, since it can increase the absorption of iron and aluminum, it should not be supplemented within several hours of aluminum-based antacids.

How to take it

People at risk of CRPS can take 500 mg of vitamin C once a day, ideally in the morning.

People with joint pain not associated with CRPS can also take 500 mg of vitamin C once a day, but if the pain has not lessened after two months, supplementation need not be continued.

Further research is needed to determine if vitamin C is better absorbed with food.

Secondary Options

Cissus Quadrangularis

Why it's a secondary option

Cissus quadrangularis has long been used in Ayurvedic medicine to promote bone healing and relieve joint pain. Its benefits may stem from its anti-inflammatory properties and its ability to induce growth factors in connective tissues.

Today, *cissus quadrangularis* is often supplemented by athletes (particularly martial artists) to relieve joint pain. Much more research is needed to confirm this effect, but preliminary evidence is promising.

Supplementation, however, should not serve as primary treatment for injuries. It can be used to alleviate the pain while tending to an injury, but alleviating the pain in order to continue exercising will only worsen the injury.

How to take it

Take a *Cissus quadrangularis* extract standardized to 2.5% ketosteroid. Start with 300–600 mg/day. Over a month, increase your daily dosage until pain disappears or you reach 3,200 mg/day.

Cissus quadrangularis may have muscle-relaxing properties, so it should be taken after a workout or before bed.

MSM

Why it's a secondary option

Methylsulfonylmethane (MSM) is the oxidized form of dimethyl sulfoxide (DMSO). Both are chemically similar sulfur compounds, but MSM is prefered over DMSO because it is more stable, does not smell as bad, and does not cause skin irritations. MSM can be found in foods (such as coffee, corn, tomatoes, or tea), but only in tiny amounts.

In people with knee osteoarthritis, MSM supplementation may improve

physical functioning, but results are mixed with regard to reductions in pain, swelling, or stiffness.

How to take it

The best study on MSM used 1,125 mg three times a day (i.e., 3,375 mg/day). There is no proven benefit to taking more than 6/g per day.

MSM has been tested with *Boswellia serrata*, with glucosamine, and with a combination of glucosamine and chondroitin. In each case, the addition of MSM seems to add a slight benefit, but further research is needed for confirmation.

Pine Bark

Why it's a secondary option

The flavonoids called procyanidins can improve blood flow and reduce inflammation. Pycnogenol is a patented pine bark extract standardized to 65–75% procyanidin; there is preliminary evidence that it can benefit people with osteoarthritis, but further research is needed for confirmation.

Grape seed extracts are rich in procyanidins and cheaper than pine bark extracts, but their benefits to joint health have never been directly demonstrated.

How to take it

To supplement **Pycnogenol**, take 100–200 mg once a day with a meal.

To supplement a **grape seed extract**, take 200–400 mg once a day with a meal.

Maximum benefit is usually experienced after three months of continuous supplementation.

Inadvisable Supplements

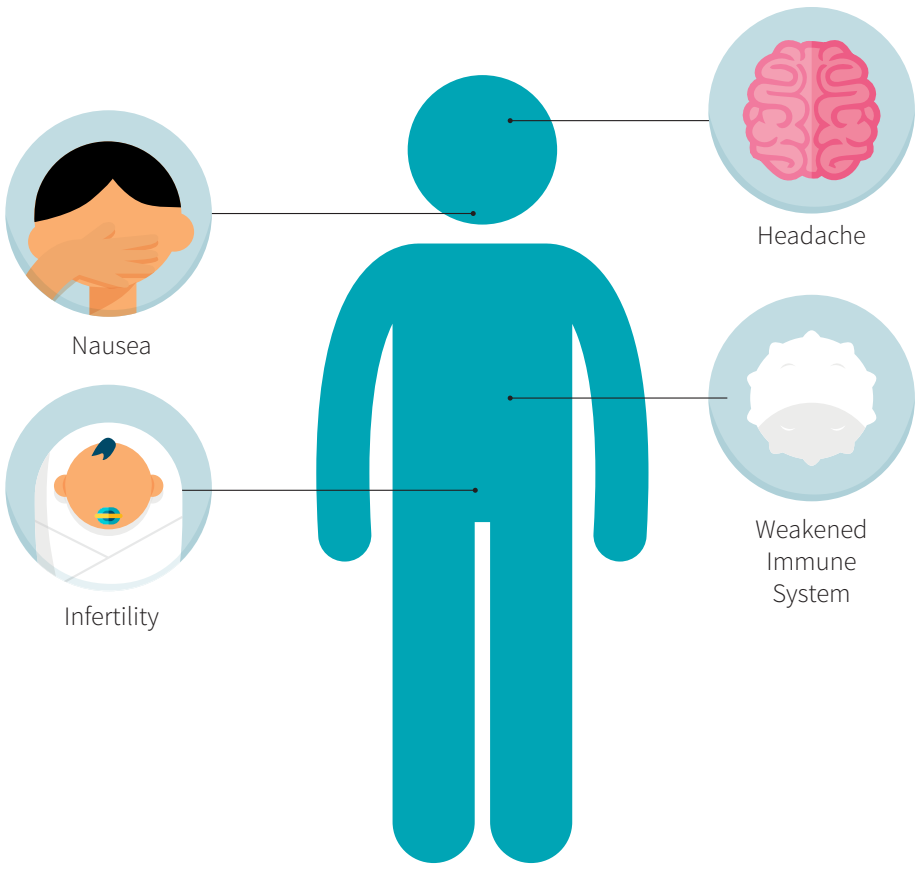
Many are the supplements absent from this guide because of a relative lack of scientific evidence. Pain is a lucrative business, so unsubstantiated claims are numerous. As a rule, avoid "proprietary blends" that hide from you how much of each ingredient you are actually getting, as well as oral or topical formulations containing homeopathic (read: very small) amounts of active ingredients.

Thunder God Vine

Thunder god vine (*Tripterygium wilfordii*) is used in traditional Chinese medicine to treat a wide range of conditions. By decreasing the number of white blood cells, it reduces inflammation (and thus pain) around the joints, but it also makes the body more susceptible to infection, leading to sickness and potentially death.

Though it appears to be effective at treating rheumatoid arthritis, ***thunder god vine is not safe*** and should not be supplemented.

Figure 4: Side effects of thunder god vine



The effective dose of this supplement is close to a harmful dose, which can cause a host of health issues

Assembling Your Stack

Incorporating Core Supplements

Joint pain is caused by a variety of factors. Since no supplement can address all of them, there is no core supplement shared by the different joint health stacks.

Incorporating Options

For people with osteoarthritis

Each day, with food, take 1.2 g of chondroitin sulfate, 1.5 g of glucosamine sulfate, 100–200 mg of Pycnogenol, and some collagen in the form of **undenatured type-II collagen** (40 mg), **hydrolyzed collagen** (10 g), or **gelatin** (10–15 g).

After one month, add either *Boswellia serrata* or curcumin to your regimen. If your condition doesn't improve, switch to the other plant extract. If your situation improves with either extract, wait for it to stabilize, then add the other extract; if your condition improves some more, you can keep taking both extracts.

Studies on ***Boswellia serrata*** tend to use one of two patented extracts: **5-Loxin** and **Aflapin**. To supplement either, take 100–250 mg once a day. Alternatively, you can try taking 1,800 mg of the plant's **gum oleoresin** three times a day (i.e., 5,400 mg/day).

Curcumin is a component of turmeric (*Curcuma longa*). Its bioavailability can be greatly increased by taking it with piperine (a black pepper extract) or by combining it with lipids (BCM-95, Meriva). To supplement **curcumin with piperine**, take 500 mg of the former with 20 mg of the latter, thrice a day (i.e., 1.5 g of curcumin and 60 mg of piperine per day). To supplement **BCM-95** or **Meriva**, take 500 mg twice a day (i.e., 1 g/day).

For people with rheumatoid arthritis

Get 3 g of combined EPA and DHA per day by eating fatty fish (e.g., 200 g of salmon) or by taking fish oil softgels (with food, to reduce the chance of fishy burps). Vegans and vegetarians have the option of taking algal oil softgels.

In addition, take 40 mg of undenatured type-II collagen once a day.

For people at risk of complex regional pain syndrome (CRPS)

Take 500 mg of vitamin C once a day, ideally in the morning.

For people with joint pain related to athletics

Try the stack "for people with rheumatoid arthritis" above. You can choose to replace the **undenatured type-II collagen** (40 mg) by some **hydrolyzed collagen** (10 g) or some **gelatin** (10–15 g).

Cissus quadrangularis is a popular option among athletes, but further research needs to confirm its benefits before it can be included in this stack.

Remember that ***supplementation should not serve as primary treatment for injuries***. It can be used to alleviate the pain while tending to an injury, but alleviating the pain *in order to continue exercising* will only worsen the injury.

For people with joint pain unrelated to a disease or to athletics

Try the stack "for people with rheumatoid arthritis" above. You can choose to replace the **undenatured type-II collagen** (40 mg) by some **hydrolyzed collagen** (10 g) or some **gelatin** (10–15 g).

If your pain persists, add the stack "for people with osteoarthritis" above. Although collagen is a supplement in both stacks, taking both stacks doesn't mean doubling the collagen dose.

Other options

MSM (3–6 g/day) can be added to any stack that includes chondroitin, glucosamine, or *Boswellia serrata*.

Pycnogenol (100–200 mg) can be replaced by a grape seed extract (200–400 mg). The latter is cheaper than the former and is *thought* to work similarly, but its benefits to joint health have never been directly demonstrated.

FAQ

Can I add to my stack a supplement not covered in this guide?

Supplement your current stack for a few weeks before attempting any change. Talk to your doctor and research each potential new addition in advance. Check for known negative interactions with other supplements in your current stack, but also for synergies. If two supplements are synergistic or additive in their effects, you might want to use lower doses for each.

Can I modify the recommended doses?

If a supplement has a recommended dosage range, stay within that range. If a supplement has a precise recommended dose, stay within 10% of that dose. Taking more than recommended could be counterproductive or even dangerous.

Should I take my supplements with or without food? And at what time?

Answers are provided in each supplement entry whenever the evidence permits. Too often, however, the evidence is either mixed or absent. Besides, a supplement's digestion, absorption, and metabolism can be affected differently by different foods. Fat-soluble vitamins (A, D, E, K), for instance, are better absorbed with a small meal containing fat than with a large meal containing little to no fat.

Starting with half the regular dose can help minimize the harm a supplement may cause when taken during the day (e.g., tiredness) or in the evening (e.g., insomnia).

Precautions and Troubleshooting

Stack components are seldom studied together. The safest way to add supplements to your daily routine is one at a time, at least a couple of weeks apart, to better assess the effects (and side effects) of each new addition. Start at half the regular dose for a week, then slowly increase to the regular dose if you are not experiencing the desired effects.

Since minerals and vitamins (especially the fat-soluble vitamins: A, D, E, and K) can accumulate in the body, it is best to consider supplementation only after a dietary evaluation. Track what you eat for a week; if, on average, you are getting less than 80% of your Recommended Dietary Allowance or Adequate Intake, supplementation becomes an option, though first you should try eating more foods rich in the desired vitamin or mineral.